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Research Paper

# The Alaali Systemic Risk Index (ASRI): A Vulnerability–Stress–Transmission Architecture

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**Abstract**

Existing systemic-risk measures capture important dimensions of market loss, institutional spillovers, financial-sector vulnerability, financial stress, and interconnectedness. However, the literature reviewed in this study does not reveal a widely established framework that explicitly organizes corporate financial fragility, stress activation and conditioning, and transmission exposure within a common systemic-risk architecture. This study employed an integrative literature review and conceptual-theoretical synthesis covering systemic risk, corporate financial fragility, financial and systemic stress, macro-financial vulnerability, transmission mechanisms, and early-warning approaches. The synthesis produced the Alaali Systemic Risk Index (ASRI) conceptual framework. ASRI distinguishes Corporate Financial Fragility as underlying vulnerability, Financial-Market Stress as activation and amplification, Macro-Financial Instability as the conditioning environment, and Transmission Exposure as propagation capacity. Its central theoretical logic is that corporate vulnerability becomes systemically consequential when stress activates it and it transmits through economically significant channels. ASRI is a conceptual rather than calibrated or predictive instrument. Its contribution is the vulnerability–stress–transmission–outcome architecture, which provides a basis for future operationalization, country-sensitive calibration, model specification, and empirical validation.

**Keywords:** *Systemic risk, Financial stability, Corporate financial fragility, Financial stress, Transmission exposure, Composite indicator*

## INTRODUCTION

### Background: Systemic Risk and Financial Stability

Systemic risk refers to financial stress that disrupts the functioning of the financial system or materially impairs the real economy. It is therefore broader than a loss incurred by an individual institution, investor, or firm. A systemic event emerges when distress spreads through interconnected balance sheets, financial markets, credit relationships, or real-economy channels and produces consequences beyond the original source of disruption (De Bandt & Hartmann, 2000; Bisias et al., 2012).

The global financial crisis demonstrated that liquidity pressure, credit contraction, declining asset values, and loss of confidence may reinforce one another rather than operate as isolated events (Adrian & Shin, 2010). Brunnermeier (2009) describes how funding constraints and market liquidity can interact to intensify financial stress. Contemporary financial-stability monitoring similarly recognises that vulnerabilities can accumulate across sectors before becoming visible as broader market or macroeconomic pressure (International Monetary Fund [IMF], 2024).

Systemic risk is thus characterized by contagion, amplification, and feedback effects. A local shock may become systemically significant when it reaches sufficiently interconnected institutions, strategically important sectors, or highly concentrated markets. Effective analysis must therefore


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examine not only where vulnerability exists but also how it can spread, intensify, and affect the stability of the broader financial and economic system.

**Systemic Risk Beyond Financial Institutions**

Banks and other financial institutions remain central to systemic-risk analysis because they allocate credit, provide liquidity, and connect households, firms, markets, and governments. However, financial-sector fragility is not the only source of system-wide pressure. Corporate indebtedness, refinancing strain, liquidity shortages, weak earnings, and unstable cash flows can create significant stress when they affect economically important firms or sectors.

Minsky (1986) argued that periods of apparent stability can encourage increasingly fragile financing structures, leaving firms vulnerable when interest costs rise or revenues weaken. Financial stress can then reduce investment, employment, and production, worsening economic conditions and reinforcing balance-sheet pressure. This mechanism aligns with the financial accelerator framework, in which deteriorating borrower conditions affect credit availability and amplify macroeconomic downturns (Bernanke et al., 1999; Kiyotaki & Moore, 1997).

Non-financial firms do not become systemically relevant merely because they face financial difficulty. Their relevance depends on their economic scale, sectoral concentration, supply-chain position, employment significance, funding relationships, and potential links to public-sector liabilities. Evidence from crisis periods shows that financially constrained firms reduce investment and operating expenses, thereby transmitting financial pressure into the real economy (Campello et al., 2010). Corporate fragility should therefore be treated as a potential systemic input rather than solely as an issuer-specific credit concern (Cucinelli & Soana, 2023; Li et al., 2023).

**Limitations of Existing Systemic-Risk Measures**

Existing risk measures contribute to financial stability analysis. Value-at-Risk and Expected Shortfall are widely used to estimate potential losses under adverse market conditions and remain important tools for portfolio and institutional risk management (Jorion, 2006). CoVaR advances systemic-risk analysis by examining the risk to the financial system when a particular institution is under stress, thereby capturing conditional spillover effects (Adrian & Brunnermeier, 2016).

Other measures focus more directly on systemically important financial institutions. Marginal Expected Shortfall and SRISK assess institutions' exposure to market stress and their expected capital shortfalls during systemic events (Acharya et al., 2017; Brownlees & Engle, 2017). These approaches are particularly valuable for evaluating vulnerabilities in the financial sector.

However, these measures were primarily designed for specific analytical purposes: market-loss estimation, conditional financial spillovers, or capital shortfall assessment. They do not fully capture the interactions among corporate fragility, financial-market stress, macro-financial conditions, and the channels through which these pressures may become systemically consequential. This limitation does not diminish their importance. Rather, it indicates the need for a complementary framework that situates corporate-sector vulnerability within a broader systemic-risk structure.

**Research Gap**

The systemic-risk literature includes established measures of market loss, institutional spillovers, financial interconnectedness, expected capital shortfall, and broader financial and macro-financial stress. It also presents substantial evidence on corporate leverage, liquidity constraints, debt maturity, refinancing risk, and financial distress. These research traditions offer important but distinct perspectives on the sources, amplification, transmission, and consequences of financial vulnerability.

However, the literature reviewed in this study does not identify a widely established framework that jointly organizes corporate financial fragility, financial-market stress, macro-financial conditions, and transmission exposure according to their distinct theoretical roles in the development of systemic-risk pressure. Existing approaches may integrate multiple financial and macro-financial dimensions, but they do not consistently position corporate financial fragility as an underlying vulnerability, market and macro-financial stress as activating or conditioning forces, and transmission exposure as the mechanism through which corporate distress may propagate beyond the originating firms or sectors.

The research gap is therefore not the absence of multidimensional systemic-risk or financial-stress frameworks per se. Rather, it concerns the explicit integration of corporate financial fragility and transmission exposure within a vulnerability–stress–transmission–outcome architecture. This study does not argue that prior research has ignored corporate distress or that established systemic-risk measures are unsuitable for their intended purposes. Instead, it develops a complementary conceptual architecture that distinguishes the theoretical roles through which corporate vulnerability may be activated, transmitted, and transformed into broader systemic-risk pressure.

**Research Objective and Research Questions**

The objective of this study is to develop the Alaali Systemic Risk Index (ASRI) as a conceptual framework for analyzing systemic-risk pressure arising from the interaction of corporate fragility, financial-market stress, macro-financial instability, and transmission exposure. The framework recognizes that the systemic relevance of corporate distress depends not only on the weakness of firms' financial positions but also on the conditions and channels through which such weakness can spread.

The study addresses the following research questions:

1. What are the limitations of existing systemic-risk measures in capturing corporate-sector fragility?
2. Which dimensions of corporate fragility are relevant to systemic-risk pressure?
3. Through which channels can corporate distress become systemically consequential?
4. How can these dimensions be integrated into a conceptual systemic-risk index framework?
5. What pathway is required for future ASRI calibration and empirical validation?

**Contribution and Paper Structure**

This study introduces ASRI as a conceptual index framework built around a vulnerability–stress–transmission–outcome architecture. Its principal theoretical contribution is not merely combining multiple risk dimensions or naming a new index. Rather, ASRI distinguishes underlying corporate financial vulnerability, activating and conditioning financial stress, transmission capacity, systemic-risk pressure, and potential systemic outcomes as analytically distinct yet dynamically connected elements.

This architecture provides a structured basis for assessing when corporate financial fragility may remain contained and when it may become systemically consequential. It also establishes a pathway for selecting, operationalizing, calibrating, weighting, and empirically validating indicators without assuming that ASRI ultimately takes a simple additive form. The remainder of the paper reviews and positions the relevant literature, develops the ASRI conceptual architecture and theoretical propositions, and outlines its future operationalization, validation, limitations, and implications.

## LITERATURE REVIEW

### Conceptual Foundations of Systemic Risk

Systemic risk concerns the possibility that distress originating in an institution, market, sector, or economic segment spreads sufficiently to impair the broader financial system or the real economy. It differs from idiosyncratic distress, which remains confined to a single entity, and from sectoral distress, which affects multiple firms but may remain contained. A systemic event occurs when interacting financial and economic pressures generate disruption across institutions, markets, and the real economy (De Bandt & Hartmann, 2000).

Systemic outcomes depend not only on shock magnitude but also on the vulnerability of affected entities and the capacity for distress to propagate. Financial interconnectedness can transmit local liquidity shocks (Allen & Gale, 2000), while asset-price declines, funding pressure, and market illiquidity can reinforce one another (Brunnermeier, 2009). Network structures may enhance resilience under normal conditions yet accelerate contagion when highly connected nodes are affected (Haldane & May, 2011).

Systemic risk can therefore be understood as a process with analytically distinct roles: underlying vulnerability, activating or conditioning stress, transmission capacity, and potential systemic outcomes. A severe vulnerability may remain contained when activating stress or transmission capacity is limited, whereas a more moderate vulnerability may become systemically consequential when adverse conditions coincide with concentrated exposures, critical funding relationships, strategic firms, or interconnected markets. This process distinction provides the theoretical foundation for ASRI.

### Market-Risk Measures: Value-at-Risk and Expected Shortfall

Value-at-Risk (VaR) estimates potential loss over a specified horizon and confidence level (Jorion, 2006), while Expected Shortfall estimates average loss beyond the VaR threshold and better captures tail-loss severity (Artzner et al., 1999). The Basel Committee on Banking Supervision (2019) incorporated Expected Shortfall into market-risk capital requirements because it is more sensitive to tail risk.

Their primary purpose, however, is to measure losses. They do not independently identify whether losses originate from corporate financial fragility, deteriorating market conditions, macro-financial pressures, or transmission among firms, banks, markets, and governments. They therefore serve a different analytical function than a framework designed to distinguish vulnerability, activation, transmission, and systemic outcomes.

### Institution-Centred Systemic-Risk Measures

1. **CoVaR**

   CoVaR measures financial-system risk conditional on an institution being in distress, shifting attention from stand-alone risk to an institution's contribution to system-wide risk (Adrian & Brunnermeier, 2016). It shows that systemic importance cannot be inferred solely from an institution's individual volatility or failure probability.

   However, CoVaR primarily captures conditional dependence between an institution and the financial system. Its principal analytical unit does not explicitly organize non-financial corporate balance-sheet vulnerability together with operational, real-economy, and sovereign transmission channels. ASRI therefore addresses a different conceptual problem rather than seeking to replace the conditional spillover function performed by CoVaR.

2. **MES and SRISK**

Marginal Expected Shortfall (MES) measures the expected equity loss of a financial institution during extreme market declines, while SRISK estimates the expected capital shortfall during severe downturns using leverage, equity market value, and sensitivity to market losses (Acharya et al., 2012; Brownlees & Engle, 2017). Their central contribution is assessing institutions by their vulnerability during system-wide stress rather than by individual default risk alone (Acharya et al., 2017).

MES and SRISK are primarily oriented toward financial institutions and their vulnerability to market stress. They do not serve the same conceptual function as a framework that begins with non-financial corporate fragility and then distinguishes the external conditions that activate that fragility from the channels through which its consequences may propagate. This difference in analytical purpose is central to ASRI's positioning.

**Connectedness and Network Measures**

Network approaches examine the channels through which shocks spread across institutions and markets. Billio et al. (2012) measure connectedness across finance and insurance, while Diebold and Yilmaz (2014) quantify directional spillovers. Acemoglu et al. (2015) further show that concentrated networks can produce nonlinear systemic effects when highly connected nodes are affected.

These approaches establish interconnectedness as a central source of systemic amplification and are therefore particularly relevant to the transmission component of ASRI. However, many network measures focus on financial-market, banking, or insurance relationships. ASRI extends the conceptual focus to transmission originating from corporate vulnerability through financial, real-economy, market-confidence, and sovereign channels.

**Corporate Financial Fragility Literature**

1. **Leverage, Debt Overhang, and Refinancing Risk**

   High leverage increases sensitivity to revenue declines, interest-rate increases, asset-price declines, and refinancing constraints. Minsky (1986) argues that periods of stability can encourage increasingly fragile financing structures, while Myers (1977) identifies debt overhang as a constraint on productive investment.

   Refinancing risk becomes particularly important when debt maturities are concentrated or financial conditions tighten. Almeida et al. (2012) find substantial real effects among firms with debt maturing during the global financial crisis, while Kalemli-Ozcan et al. (2022) highlight the relationship among rollover risk, debt overhang, and investment.

   Recent evidence reinforces the importance of examining corporate vulnerability alongside financial-sector conditions. IMF stress testing of the corporate and banking sectors in the Middle East and North Africa shows that higher interest rates can substantially increase corporate debt at risk and that combined corporate, liquidity, and banking-sector stresses can affect bank capital, credit provision, and output (Alter et al., 2024; International Monetary Fund [IMF], 2024). Corporate balance-sheet weakness can therefore constitute an underlying vulnerability, while its systemic consequences depend on the conditions under which that vulnerability is activated and transmitted.

2. **Liquidity, Cash Flow, and Earnings Instability**

   Liquidity pressure arises when firms lack sufficient resources to meet obligations, sustain operations, or refinance liabilities. Cash-flow and earnings instability intensify this vulnerability. Opler and Titman (1994) show that financially distressed firms can experience substantial operational deterioration.

   Financial constraints can also affect the real economy. Campello et al. (2010) find that

constrained firms reduced investment, employment, technology spending, and marketing during the financial crisis, while Ivashina and Scharfstein (2010) document a contraction in bank lending. These findings illustrate an important distinction for ASRI: liquidity and cash-flow weakness represent underlying corporate vulnerability, whereas the wider consequences of that weakness depend on external stress and transmission capacity.

Recent macro-financial stress analysis similarly indicates that declining corporate profitability and interest-coverage capacity can interact with higher rates and banking-sector exposures rather than operating as isolated firm-level phenomena (IMF, 2024). This interaction reinforces the need to distinguish corporate fragility from the mechanisms through which it becomes systemically consequential.al.

3. **Corporate Distress and the Real Economy**

Corporate distress can reduce investment, employment, production, and supplier payments, transmitting weakness to households and other firms. The financial accelerator framework explains how deteriorating balance sheets can raise borrowing costs and restrict credit, amplifying declines in economic activity (Bernanke et al., 1999). Kiyotaki and Moore (1997) similarly show that declining collateral values can intensify credit cycles, while Acemoglu et al. (2012) demonstrate that shocks to key nodes in production networks can produce disproportionate macroeconomic effects.

Corporate distress therefore provides a bridge between firm-level vulnerability and systemic analysis. However, financial distress alone does not determine whether systemic consequences follow. Economic significance, interconnectedness, banking exposure, supply-chain relationships, and other transmission channels influence whether the consequences remain firm-specific, become sectoral, or propagate more widely.

**Financial-Stress, Systemic-Stress, and Financial-Conditions Frameworks**

A substantial literature extends beyond institution-specific systemic-risk measures by constructing broader indicators of financial stress and financial conditions. Financial-stress indices typically combine information from several segments of the financial system to identify periods in which market functioning, liquidity, funding, credit, or asset prices exhibit unusually elevated stress. Such measures demonstrate that multidimensional aggregation is already established within financial stability research and therefore cannot, by itself, constitute ASRI's principal novelty.

Financial-stress indices may incorporate credit, funding, equity, foreign-exchange, real estate, and securitization markets to capture the intensity and distribution of stress across the financial system (Oet et al., 2015). Related systemic-stress approaches similarly recognize that stress can arise simultaneously across markets and that co-movement and amplification across components may be more informative than isolated indicators.

Financial-conditions indices address a related but distinct analytical problem. Rather than identifying corporate financial vulnerability directly, they characterize the broader environment in which borrowing, investment, asset pricing, and financing decisions occur. Interest rates, credit spreads, asset prices, exchange rates, and other market variables can therefore provide information about whether financial conditions are supportive or restrictive.

These traditions are important for ASRI because they demonstrate that market and macro-financial variables have already been integrated into multidimensional monitoring systems. ASRI consequently does not claim novelty merely from combining multiple financial indicators. Its proposed distinction lies instead in assigning different theoretical functions to the components of

systemic-risk formation: corporate financial fragility represents underlying vulnerability; financial-market stress represents activation and amplification; macro-financial instability represents the conditioning environment; and transmission exposure represents the capacity through which distress may propagate.

**Macro-Financial Vulnerability and Early-Warning Systems**

Macro-financial vulnerability and early-warning research offer another important comparison. Early-warning systems seek indicators, or combinations of indicators, that signal future financial instability or crises. Traditional approaches have emphasized credit developments, asset prices, leverage, capital flows, and macroeconomic conditions, while recent research increasingly incorporates nonlinear modeling, machine learning, institutional information, and alternative indicators.

Hennig et al. (2023) examine how asset-price measures can predict financial crises and show that asset-price information can complement conventional early-warning metrics. Allaj and Sanfelici (2023) develop early-warning systems for financial instability using market-based indicators tied to realized variance and the market's capacity to absorb price disturbances. Roy (2023) similarly finds that shifts in market risk perception contain information relevant to predicting systemic banking crises.

Recent studies have further advanced early-warning modeling. Huynh and Uebelmesser (2024) show that political and institutional indicators can improve systemic banking-crisis prediction when combined with conventional macro-financial variables. Chen et al. (2024) employ a temporal convolutional network for financial-crisis prediction and identify stock prices and real GDP growth as particularly important contributors in their model. Reimann (2024) compares conventional logistic regression with several machine-learning approaches and finds that advanced models can capture nonlinear relationships between early-warning indicators and financial crises.

This literature demonstrates that sophisticated multidimensional and nonlinear approaches to financial vulnerability already exist. ASRI therefore should not be positioned as novel merely because it incorporates multiple variables or anticipates nonlinear interactions. Its distinction is more specific: the conceptual separation of corporate-originated vulnerability from the stress conditions that activate or condition it and from the transmission capacity through which corporate distress may become systemically consequential.

ASRI also differs from an empirically validated early-warning system at this stage. Early-warning studies explicitly test whether indicators predict subsequent instability or crises (Allaj & Sanfelici, 2023; Chen et al., 2024; Huynh & Uebelmesser, 2024; Reimann, 2024). ASRI presently specifies the conceptual architecture that would precede such testing. Any claim that ASRI functions as an early-warning instrument must therefore depend on future calibration, outcome definition, and out-of-sample predictive validation.

**Corporate-Sector Vulnerability Monitoring and Macro-Financial Linkages**

Corporate-sector surveillance provides additional context against which ASRI must be positioned. Corporate vulnerability monitoring commonly considers leverage, interest-coverage capacity, liquidity, profitability, debt maturity, refinancing requirements, and debt at risk. These indicators show where corporate financial fragility exists but do not necessarily establish whether that fragility will generate system-wide consequences.

Recent IMF analysis offers a particularly relevant example. Corporate and banking stress tests for MENA economies explicitly link corporate profitability, interest-coverage deterioration, debt at risk, banking-sector losses, credit provision, and macroeconomic output under adverse financial conditions (IMF, 2024). This evidence shows that corporate-sector vulnerability can

already be examined jointly with banking and macroeconomic stress. The distinctive question for ASRI is therefore not whether these connections exist, but how their different theoretical roles can be organized within a general systemic-risk architecture.

Macroeconomic conditions influence corporate and financial vulnerabilities through interest rates, inflation, growth, credit availability, exchange rates, commodity prices, capital flows, and sovereign conditions. Borio (2014) argues that financial cycles interact closely with macroeconomic conditions, while Claessens and Kose (2018) identify feedback mechanisms between the financial system and the real economy.

Credit aggregates can signal accumulating financial vulnerabilities (Drehmann et al., 2011), while recent financial-stability analysis emphasizes the interaction of higher interest rates, corporate-sector stress, liquidity pressure, banking resilience, and real-economy outcomes (IMF, 2024). Macro-financial conditions should therefore not be treated as another form of corporate fragility. Within ASRI, they constitute a conditioning environment that can intensify or mitigate the activation and propagation of underlying corporate vulnerability.

**Literature Synthesis and Theoretical Positioning**

The literature reviewed above shows that systemic risk is already examined through multiple complementary analytical traditions. VaR and Expected Shortfall measure market losses; CoVaR captures conditional systemic spillovers; MES and SRISK assess financial-institution vulnerability under market stress; network approaches analyze interconnectedness and contagion; financial-stress and systemic-stress indices integrate information across financial markets; financial-conditions approaches characterize broader financing environments; early-warning systems combine macro-financial, market, institutional, and increasingly nonlinear predictive information; and corporate-sector monitoring evaluates leverage, liquidity, refinancing, profitability, and related balance-sheet vulnerabilities.

Recent research further demonstrates that multidimensional integration, nonlinear relationships, and interactions among financial and macroeconomic variables are already established features of systemic-risk and early-warning research (Allaj & Sanfelici, 2023; Hennig et al., 2023; Roy, 2023; Chen et al., 2024; Huynh & Uebelmesser, 2024; Reimann, 2024). Similarly, recent corporate-sector stress testing explicitly links corporate vulnerability to banking and macroeconomic consequences (IMF, 2024). Therefore, ASRI's contribution cannot rest on multidimensional integration alone.

Rather, the literature reviewed in this study does not reveal a widely established framework that explicitly organizes corporate financial fragility, stress activation and conditioning, transmission capacity, systemic-risk pressure, and potential systemic outcomes by their distinct theoretical roles within a single architecture. ASRI's likely distinctive contribution is therefore the explicit integration of corporate financial fragility and transmission exposure within a vulnerability–stress–transmission–outcome structure.

In this architecture, Corporate Financial Fragility represents underlying vulnerability. Financial-Market Stress represents activation and amplification. Macro-Financial Instability represents the conditioning environment. Transmission Exposure represents propagation capacity. Their interaction may generate Systemic-Risk Pressure, while observable financial or economic disruptions constitute potential systemic outcomes against which an operational ASRI could be validated.

ASRI therefore complements rather than replaces established systemic-risk, financial-stress, financial-conditions, corporate-vulnerability, or early-warning approaches. Its theoretical proposition is that similar levels of corporate financial weakness may have substantially different systemic implications, depending on prevailing market and macro-financial conditions and,

critically, on the capacity for distress to propagate across financial, real-economy, market-confidence, and sovereign channels.

ASRI also recognizes that these relationships are context dependent. Financial structure, regulatory capacity, market depth, ownership structures, and institutional conditions can influence how vulnerability is activated, transmitted, and absorbed. Country sensitivity therefore remains relevant to future operational calibration, even though it does not replace the framework's central vulnerability–stress–transmission logic.

**Table 1**. Positioning ASRI Against Existing Approaches

| Approach | Primary Analytical Focus | Core Contribution | Relationship to ASRI |
|---|---|---|---|
| Value-at-Risk / Expected Shortfall | Portfolio or entity | Tail-loss measurement | Measures losses rather than the vulnerability–transmission process |
| CoVaR | Institution and financial system | Conditional systemic spillovers | Captures conditional spillovers rather than the corporate-originated process |
| SRISK / MES | Financial institution | Capital shortfall under market stress | Primarily financial-institution focused |
| Connectedness / Network Measures | Financial and economic networks | Interconnectedness and contagion | Informs ASRI's transmission layer |
| Financial-/Systemic-Stress Indices | Financial markets/system | Multimarket stress measurement | Informs ASRI's activation and amplification layer |
| Financial-Conditions Approaches | Financing environment | Broader financial conditions | Informs ASRI's conditioning environment |
| Macro-Financial / Early-Warning Systems | Financial and macroeconomic system | Vulnerability monitoring and crisis prediction | Provides benchmarks for future validation |
| Corporate-Sector Vulnerability Monitoring | Corporate sector | Corporate financial vulnerability | Informs ASRI's underlying vulnerability layer |
| **ASRI** | **Corporate–market–macro–transmission system** | **Vulnerability–stress–transmission–outcome architecture** | **Requires future calibration and empirical validation** |

ASRI therefore contributes an organizing theoretical framework rather than a completed empirical measure. Its contribution lies in distinguishing underlying vulnerability, activation and conditioning, transmission capacity, systemic-risk pressure, and potential outcomes, providing the basis for future operationalization and empirical validation.

## RESEARCH METHOD

### Research Design

This study uses an integrative literature review and conceptual-theoretical synthesis to develop ASRI. This approach is appropriate for integrating diverse research streams and developing conceptual relationships rather than testing statistical hypotheses (Snyder, 2019; Torraco, 2016).

The study does not estimate ASRI scores, evaluate predictive performance, or claim empirical validation. It develops the conceptual architecture that distinguishes underlying vulnerability, activating and conditioning stress, transmission capacity, and potential systemic outcomes.

**Literature Identification and Selection**

The review draws on peer-reviewed research identified through Scopus, Web of Science, and Google Scholar, along with publications from the IMF, BIS, FSB, and central banks. Searches covered systemic risk, financial stability, corporate fragility, corporate debt, financial contagion, financial and systemic stress, financial conditions, macro-financial vulnerability, transmission mechanisms, and early-warning systems.

The literature search and review process began in February 2025, during the initial development of the ASRI conceptual architecture. The first version of the manuscript was published on SSRN on March 20, 2025, and the literature review continued iteratively through August 2026 as the architecture was further developed and substantially revised. No predefined publication-year boundary was imposed, allowing both foundational studies and recent contributions to be considered. Searches focused primarily on English-language peer-reviewed journal articles, working papers, institutional reports, and other scholarly publications directly relevant to the conceptual development of ASRI. Representative search combinations included "systemic risk" AND "corporate fragility"; "financial stress" AND "systemic risk"; "corporate vulnerability" AND transmission; and "early warning" AND financial crisis.

Because the study adopts an integrative rather than a systematic review design, literature identification followed an iterative, purposive, and theory-driven process rather than a predefined record-based screening protocol. Accordingly, database retrieval counts, duplicate-removal counts, and sequential title/abstract and full-text screening totals were not generated as systematic-review statistics. Sources were retained when they contributed directly to systemic-risk measurement, corporate financial vulnerability, stress conditions, transmission mechanisms, or macro-financial and early-warning analysis. Sources without a substantive connection to these analytical categories were excluded.

To provide an audit trail appropriate to an integrative review, retained literature was organized by its primary analytical contribution to ASRI: underlying corporate vulnerability, activating or amplifying financial stress, macro-financial conditioning, transmission exposure, or systemic outcomes. Where a source informed more than one category, its classification was determined by its principal theoretical function within the ASRI architecture. Table 2 summarizes the literature-identification, selection, and classification procedure.

**Table 2**. Literature Review Audit Trail

| Review Element | Procedure |
|---|---|
| **Review design** | Integrative literature review and conceptual-theoretical synthesis |
| **Search period** | February 2025–August 2026; the first manuscript version was published on SSRN on March 20, 2025, with the review continuing iteratively during subsequent development and revision |
| **Databases** | Scopus, Web of Science, and Google Scholar |
| **Institutional sources** | IMF, BIS, FSB, and central banks |
| **Publication period** | No predefined publication-year restriction |
| **Language** | Primarily English-language sources |
| **Document types** | Peer-reviewed journal articles, working papers, institutional reports, and other relevant scholarly publications |
| **Search strategy** | Iterative, purposive, and theory-driven |
| **Representative** | "systemic risk" AND "corporate fragility"; "financial stress" AND |

| | |
|---|---|
| **search combinations** | "systemic risk"; "corporate vulnerability" AND transmission; "early warning" AND financial crisis |
| **Core search domains** | Systemic risk; financial stability; corporate fragility; corporate debt; financial contagion; financial and systemic stress; financial conditions; macro-financial vulnerability; transmission mechanisms; early-warning systems |
| **Inclusion criterion** | Direct theoretical relevance to systemic-risk measurement, corporate financial vulnerability, stress conditions, transmission mechanisms, or macro-financial and early-warning analysis |
| **Exclusion criterion** | Absence of a substantive connection to the analytical categories underlying ASRI |
| **Analytical classification** | Underlying corporate vulnerability; activating/amplifying financial stress; macro-financial conditioning; transmission exposure; systemic outcomes |
| **Overlap resolution** | Sources informing multiple categories were classified according to their principal theoretical function within the ASRI architecture |
| **Record-count protocol** | No systematic-review retrieval or screening counts were generated because the review was integrative rather than record-based systematic |

**Analytical Procedure**

The synthesis proceeded in six stages. First, systemic-risk and related measurement traditions were identified and classified. Second, their analytical focus and limitations were compared. Third, corporate financial fragility was coded as an underlying vulnerability, encompassing leverage, liquidity, refinancing, and earnings/cash-flow weakness. Fourth, financial-market stress and macro-financial conditions were classified as activating/amplifying and conditioning factors, while economic concentration, strategic importance, financial linkages, supply chains, and sovereign connections were classified under Transmission Exposure. Fifth, the categories were integrated into the ASRI vulnerability–stress–transmission–outcome architecture. Sixth, theoretical propositions and requirements for future operationalization and validation were developed. When concepts overlapped, classification was determined by their theoretical function within ASRI rather than by terminology alone.

**Boundary Conditions and Research Integrity**

ASRI distinguishes corporate financial vulnerability from systemic importance and transmission capacity. Corporate weakness alone does not constitute systemic risk; its broader significance depends on stress conditions and propagation capacity.

ASRI complements established systemic-risk and financial-stability measures. This study provides no numerical weights, thresholds, predictive claims, or validated crisis scores. Future operationalization requires defined indicators, justified aggregation and weighting, sensitivity analysis, calibration, and out-of-sample validation.

## FINDINGS AND DISCUSSION

### The Alaali Systemic Risk Index (ASRI) Framework

1. **Definition of ASRI and Core Principle**

   The Alaali Systemic Risk Index (ASRI) is introduced as a conceptual framework organized around four distinct roles: corporate financial fragility as the underlying vulnerability, financial-market stress as activation and amplification, macro-financial instability as the conditioning environment, and transmission exposure as propagation capacity.

Its core principle is that vulnerability becomes systemically consequential when stress activates it and transmits it through economically significant channels. ASRI therefore distinguishes the sources of vulnerability from the conditions that intensify them, the channels through which distress propagates, and the systemic outcomes that may follow.

2. **ASRI Dimension I: Corporate Financial Fragility**

   Corporate Financial Fragility refers to internal financial conditions that increase firms' susceptibility to adverse shocks. It includes leverage and debt burden, liquidity and refinancing pressure, and earnings and cash-flow fragility. These conditions reflect underlying vulnerability rather than systemic importance or systemic risk itself.

   a. **Leverage and Debt Burden**

      Potential indicators include debt-to-assets, debt-to-equity, net debt-to-EBITDA, debt growth, and debt maturity concentration. High leverage increases sensitivity to revenue declines, interest-rate increases, and refinancing constraints (Minsky, 1986; Myers, 1977; Almeida et al., 2012). In ASRI, leverage reflects underlying financial vulnerability.

   b. **Liquidity and Refinancing Pressure**

      Potential indicators include the current ratio, cash-to-short-term-debt ratio, interest coverage, short-term-debt share, and maturity-wall exposure. Firm performance and ownership structure may also influence corporate liquidity conditions (Putri et al., 2024), while liquidity vulnerability can intensify when credit conditions tighten (Campello et al., 2010; Ivashina & Scharfstein, 2010). ASRI therefore treats liquidity and refinancing pressure as corporate vulnerabilities that may be triggered by external financial stress.

   c. **Earnings and Cash-Flow Fragility**

      Potential indicators include earnings and operating cash-flow volatility, margin deterioration, persistent negative operating cash flow, and rising interest costs. Financial distress can contribute to operating deterioration (Opler & Titman, 1994), while debt overhang and rollover risk can weaken corporate investment (Kalemli-Ozcan et al., 2022). These conditions affect firms' capacity to service debt, invest, and refinance.

3. **ASRI Dimension II: Financial-Market Stress**

   Financial-Market Stress represents the activation and amplification layer through which existing corporate vulnerabilities may be exacerbated.

   a. **Credit-Market Stress**

      Potential indicators include corporate and bond-yield spreads, default-risk premiums, credit-default-swap spreads, and tightening of lending standards. Credit spreads convey information about financial conditions and business-cycle fluctuations (Gilchrist & Zakrajšek, 2012). Credit stress can therefore expose vulnerabilities in leveraged or liquidity-constrained firms.

   b. **Equity-Market and Liquidity Stress**

      Potential indicators include market volatility, equity drawdowns, sectoral return dispersion, bid-ask spreads, and funding conditions. Funding and market liquidity can reinforce each other during stress (Brunnermeier & Pedersen, 2009), amplifying financing pressure and corporate fragility.

   c. **Investor Sentiment and Risk Appetite**

      Market expectations, investor sentiment, and noise-trader behavior can affect security prices and returns and may generate additional market risk (De Long et al., 1990; Baker & Wurgler, 2006; Handri et al., 2026). Within ASRI, sentiment acts as an

amplifying market condition rather than an independent source of systemic risk.

4. **ASRI Dimension III: Macro-Financial Instability**

   Macro-Financial Instability represents the environment in which corporate vulnerability and market stress interact.

   a. **Growth, Inflation, and Monetary Pressure**

      Potential indicators include a slowdown in GDP growth, inflation, pressure on real interest rates, credit contraction, and a decline in industrial production. Financial cycles interact with macroeconomic developments (Borio, 2014), while macroeconomic conditions can influence banking-sector performance and profitability (Melati et al., 2026). More broadly, macroeconomic and financial conditions operate through feedback mechanisms (Claessens & Kose, 2018).

   b. **External and Sovereign Conditions**

      Potential indicators include exchange-rate and commodity-price shocks, capital outflows, sovereign spreads, and fiscal stress. Global financial conditions influence domestic financial conditions (Rey, 2015). ASRI treats these factors as conditioning pressures on funding, credit availability, confidence, and resilience.

   c. **Institutional and Country Sensitivity**

      ASRI does not assume identical indicators, weights, or thresholds across countries. Banking depth, capital market development, regulatory capacity, and macroeconomic resilience can shape how systemic pressure evolves. Cross-country differences in legal and financial structures therefore support country-specific calibration (La Porta et al., 1998; Beck et al., 2003).

5. **ASRI Dimension IV: Transmission Exposure**

   Transmission Exposure represents propagation capacity: the channels and structural exposures through which corporate distress may spread beyond the originating firms or sectors. It includes economic concentration and strategic importance because these characteristics determine systemic reach rather than internal corporate financial weakness.

   a. **Financial Transmission**

      Potential channels include bank-loan exposure, corporate-bond losses, collateral deterioration, default cascades, and credit tightening. Financial interconnectedness can transmit liquidity shocks (Allen & Gale, 2000), while deteriorating borrower conditions can constrain credit and real activity (Bernanke et al., 1999). ). Banking-system stability and its determinants can further influence the capacity of financial institutions to absorb or transmit such pressures (Purnawan & Prasetyo, 2021).

   b. **Real-Economy and Strategic Transmission**

      Potential indicators and channels include sectoral output and employment shares, supply-chain centrality, production disruptions, supplier-payment effects, investment contraction, and economic concentration. Shocks to key production-network nodes can generate disproportionate aggregate effects (Acemoglu et al., 2012), while large firms can contribute materially to aggregate fluctuations (Gabaix, 2011).

   c. **Market-Confidence Transmission**

      Potential channels include rating downgrades, equity sell-offs, higher risk premiums, capital withdrawals, and declining liquidity. Liquidity pressures and fire-sale dynamics can exacerbate market deterioration (Brunnermeier & Pedersen, 2009; Shleifer & Vishny, 2011).

   d. **Sovereign-Financial Transmission**

State ownership, government guarantees, contingent liabilities, and fiscal support belong to this transmission layer because they link corporate distress to sovereign balance sheets. Bank and sovereign risks can reinforce each other (Acharya et al., 2014), while contingent liabilities can generate substantial fiscal costs (Bova et al., 2016).

6. **Systemic-Risk Pressure and Potential Outcomes**
   The interaction of underlying corporate vulnerability, market stress, macro-financial conditions, and transmission capacity may generate Systemic-Risk Pressure. Potential systemic outcomes include credit-market disruption, deterioration in banking-sector asset quality, widespread corporate defaults, market illiquidity, sovereign stress, and economic contraction. These outcomes are future validation targets rather than components of ASRI or findings of the present study.
7. **Dynamic Feedback Loops**
   ASRI adopts a dynamic view in which systemic pressure may feed back into its underlying components. Corporate fragility can interact with credit stress, increasing refinancing difficulty and defaults, thereby weakening banks and market confidence, tightening credit, and further increasing corporate fragility (Minsky, 1986; Bernanke et al., 1999; Brunnermeier & Pedersen, 2009).

   **Corporate Fragility → Credit Stress → Refinancing Difficulty → Defaults → Bank and Market Stress → Credit Tightening → Greater Corporate Fragility**

   This pathway represents a theoretical amplification mechanism that requires future empirical validation.

**Theoretical Propositions**

1. **Proposition 1: Corporate Financial Fragility**
   **Proposition 1**: Higher aggregate corporate leverage, liquidity weakness, and earnings instability heighten underlying financial vulnerability.
   Fragile debt structures are particularly vulnerable to weakening cash flows and refinancing constraints (Minsky, 1986). Within ASRI, these conditions represent vulnerability; their systemic significance depends on subsequent stress and transmission exposure.
2. **Proposition 2: Market Stress as an Amplifier**
   **Proposition 2**: Financial market stress may amplify corporate financial fragility by raising refinancing costs, weakening liquidity, and increasing risk premia.
   Funding and market liquidity may reinforce each other during periods of stress (Brunnermeier & Pedersen, 2009), while credit spreads reflect broader financial conditions (Gilchrist & Zakrajšek, 2012). Market stress therefore serves as an activation and amplification mechanism.
3. **Macro-Financial Conditioning**
   **Proposition 3**: Adverse macro-financial conditions may increase the likelihood that corporate financial fragility becomes systemically consequential.
   Growth, inflation, interest rates, and credit conditions can affect corporate resilience. Financial cycles interact with macroeconomic conditions (Borio, 2014; Claessens & Kose, 2018), making the macro-financial environment a conditioning factor in ASRI.
4. **Proposition 4: Transmission Exposure**
   **Proposition 4**: The systemic relevance of corporate distress rises with the strength of

financial, real-economy, market-confidence, and sovereign transmission exposure.

Banking exposure, economic concentration, supply-chain centrality, employment significance, and sovereign linkages can increase propagation capacity (Allen & Gale, 2000; Acemoglu et al., 2015). Transmission exposure therefore distinguishes corporate vulnerability from potential systemic consequences.

5. **Proposition 5: Non-Linearity and Threshold Effects**

   **Proposition 5**: Systemic-risk pressure may increase non-linearly when corporate financial fragility interacts with financial-market stress and adverse macro-financial conditions, particularly under high transmission exposure and when country- or sector-specific thresholds are exceeded.

   Vulnerabilities may remain manageable individually but become more consequential through interaction and propagation (Drehmann et al., 2011; Haldane & May, 2011). ASRI therefore allows for interaction and threshold effects rather than assuming simple additive relationships.

6. **Proposition 6: Institutional Sensitivity**

   **Proposition 6:** The systemic effects of corporate fragility may vary across countries depending on financial structure, market depth, ownership patterns, regulatory capacity, and sovereign-support mechanisms.

   Cross-country differences in legal, institutional, and financial structures can alter systemic transmission (Beck et al., 2003; La Porta et al., 1998). Therefore, ASRI requires contextual calibration rather than uniform thresholds.

**Operationalization and Validation of ASRI**

1. **Conceptual Status of ASRI**

   ASRI is presented as a conceptual index framework, not a calibrated or predictive instrument. The present study does not estimate ASRI values, assign final weights or thresholds, or claim predictive superiority. An operational ASRI requires indicator construction, calibration, validation, and robustness testing.

2. **Proposed Functional Relationship**

   The conceptual relationship is:

   ASRI = f (Corporate Financial Fragility, Financial-Market Stress, Macro-Financial Instability, Transmission Exposure)

   This is not a final aggregation formula. The dimensions play distinct theoretical roles and may require interactions, thresholds, lags, or country-specific parameters.

3. **Indicator Selection Protocol**

   Future indicators should have clear theoretical relevance, reliable data, comparability, limited redundancy, stable definitions, and a defined role within the ASRI architecture. Indicator selection should follow transparent principles of conceptual relevance and data quality (OECD & Joint Research Centre, 2008).

4. **Normalization, Weighting, and Aggregation**

   Future research should compare alternative normalization and weighting methods rather than impose a predetermined structure. More importantly, ASRI should be tested as alternative model forms, including a formative composite, a hierarchical index, an interaction model, and a regime-dependent specification.

   These alternatives reflect ASRI's architecture more accurately than assuming simple additive aggregation. The final specification should be determined empirically through model comparison, sensitivity analysis, and validation (OECD & Joint Research Centre, 2008; Saisana & Tarantola, 2002).

5. **Validation Strategy**
   Construct validity should test whether indicators represent their intended ASRI dimensions. Convergent and discriminant validity should compare ASRI with established systemic-risk and financial-stress measures while assessing its distinct treatment of corporate fragility and transmission exposure.
   Predictive validity should test ASRI against predefined outcomes such as corporate defaults, credit-market disruption, banking-sector deterioration, market illiquidity, or sovereign stress. Out-of-sample testing should assess performance beyond the calibration period, while robustness analysis should examine alternative indicators, specifications, normalization methods, countries, sectors, and lag structures.
6. **Data Sources and Feasibility**
   Potential sources include the IMF, BIS, World Bank, OECD, central bank data, corporate financial statements, stock exchange disclosures, and bond market databases. Commercial databases may supplement these sources where available. Final data selection should depend on reliability, frequency, and cross-country comparability.

## Discussion and Implications

1. **Theoretical Contribution**
   ASRI's contribution lies in organizing the formation of systemic risk into distinct theoretical roles: Corporate Financial Fragility as the underlying vulnerability, Financial-Market Stress as activation and amplification, Macro-Financial Instability as the conditioning environment, and Transmission Exposure as propagation capacity.
   This architecture explains why similar levels of corporate fragility may yield different systemic consequences. Vulnerability becomes systemically significant when adverse stress conditions coincide with sufficient transmission capacity, consistent with research emphasizing interconnectedness and shock propagation (Bisias et al., 2012; Acemoglu et al., 2015).
2. **Relationship with Existing Measures**
   ASRI complements rather than replaces established measures. VaR and Expected Shortfall assess losses; CoVaR captures conditional spillovers; and SRISK assesses the financial-sector capital shortfall. ASRI instead organizes the process by which corporate vulnerability → stress → transmission → systemic-risk pressure → potential outcomes.
   Its broader conceptual scope does not imply superior empirical performance. Such claims require future comparative calibration and validation.
3. **Regulatory and Central-Bank Implications**
   Conceptually, ASRI suggests that financial-stability surveillance may benefit from assessing corporate vulnerability alongside market and macro-financial stress and transmission exposure. The systemic significance of corporate weakness depends not only on its magnitude but also on its connections to banks, markets, supply chains, employment, and sovereign balance sheets (IMF, 2024; BIS, 2024; FSB, 2024). These implications remain conceptual until ASRI is empirically validated.
4. **Investor and Corporate-Governance Implications**
   ASRI suggests that corporate financial weakness may be assessed jointly with external stress and transmission conditions. Refinancing exposure, liquidity weakness, and debt concentration may become more significant when financing conditions deteriorate or when firms occupy economically significant positions.
   For corporate governance, this supports stress analysis that considers both internal financial resilience and external propagation channels.

5. **Emerging, Concentrated, and Sovereign-Linked Economies**
   ASRI may be particularly relevant for economies where major firms or sectors account for substantial shares of output, employment, banking exposure, or sovereign commitments. Bank dependence, market depth, ownership structures, and government guarantees can alter how corporate distress propagates.
   These differences support country-specific calibration rather than uniform parameters across jurisdictions (Alaali, 2026). Emerging and concentrated economies therefore provide relevant settings for future comparative validation.

## CONCLUSIONS

ASRI addresses five questions developed in this study. First, existing measures capture important aspects of systemic risk but do not consistently organize corporate-originated vulnerability within the full vulnerability–stress–transmission process. Secondly, relevant corporate vulnerabilities include leverage, liquidity and refinancing pressure, and earnings and cash-flow fragility. Third, corporate distress may propagate through financial, real-economy, market-confidence, and sovereign channels. Fourth, ASRI integrates these elements through a Corporate Financial Fragility → Stress/Conditioning → Transmission Exposure → Systemic-Risk Pressure → Potential Outcomes architecture. Fifth, operationalization requires transparent indicator selection, calibration, model specification, sensitivity analysis, and empirical validation.

ASRI is therefore presented as a conceptual index framework rather than a validated predictive instrument. Its contribution is the explicit separation and linkage of underlying corporate vulnerability, activating and conditioning stress, propagation capacity, and systemic outcomes, providing a structured basis for future empirical development and testing.

## LIMITATION & FURTHER RESEARCH

### Conceptual and Review Limitations

This study is conceptual and does not calculate ASRI scores, establish weights or thresholds, test predictive performance, or compare empirical accuracy with existing measures. The integrative review also entails review-selection subjectivity, as source identification and inclusion depend partly on researcher judgment.

A further limitation is construct-classification uncertainty. Some indicators may plausibly belong to more than one ASRI dimension. Their classification is therefore based on their primary theoretical function within the vulnerability–stress–transmission architecture and requires future empirical assessment.

### Measurement, Causality, and Aggregation Limitations

Future implementation may face constraints on data availability, frequency, and cross-country comparability. Correlation among ASRI dimensions also does not establish causal transmission, requiring future research to distinguish common exposure from genuine propagation mechanisms.

Indicator overlap may create double counting, while weighing and aggregation choices can materially affect results (OECD & Joint Research Centre, 2008; Saisana & Tarantola, 2002). These risks require transparent specification and sensitivity analysis.

### Future Empirical Research

Future research should operationalize ASRI using defined outcomes and multi-country or sectoral data. It should compare formative composite, hierarchical, interaction, and regime-

dependent specifications, test for nonlinearities and thresholds, and assess country-specific calibration. Comparisons with established systemic-risk and financial-stress measures, together with out-of-sample and robustness testing, are required before predictive claims can be substantiated.

**REFERENCES**


Acharya, V. V., Drechsler, I., & Schnabl, P. (2014). A pyrrhic victory? Bank bailouts and sovereign credit risk. *The Journal of Finance, 69*(6), 2689–2739. https://doi.org/10.1111/jofi.12206

Acharya, V. V., Engle, R., & Richardson, M. (2012). Capital shortfall: A new approach to ranking and regulating systemic risks. *American Economic Review, 102*(3), 59–64. https://doi.org/10.1257/aer.102.3.59

Acharya, V. V., Pedersen, L. H., Philippon, T., & Richardson, M. (2017). Measuring systemic risk. *The Review of Financial Studies, 30*(1), 2–47. https://doi.org/10.1093/rfs/hhw088

Acemoglu, D., Carvalho, V. M., Ozdaglar, A., & Tahbaz-Salehi, A. (2012). The network origins of aggregate fluctuations. *Econometrica, 80*(5), 1977–2016. https://doi.org/10.3982/ECTA9623

Acemoglu, D., Ozdaglar, A., & Tahbaz-Salehi, A. (2015). Systemic risk and stability in financial networks. *American Economic Review, 105*(2), 564–608. https://doi.org/10.1257/aer.20130456

Adrian, T., & Brunnermeier, M. K. (2016). CoVaR. *American Economic Review, 106*(7), 1705–1741. https://doi.org/10.1257/aer.20120555

Adrian, T., & Shin, H. S. (2010). Liquidity and leverage. *Journal of Financial Intermediation, 19*(3), 418–437. https://doi.org/10.1016/j.jfi.2008.12.002

Alaali, H. (2025). *The DFAS-FEP protocol: A global governance standard for responsible AI use and authorship integrity in financial modelling*. SSRN. https://doi.org/10.2139/ssrn.5260517

Alaali, H. M. H. (2026). AI governance in financial systems: A PGCC and emerging markets convergence framework for accountability, sovereignty, and operational control. *Journal of Countries Studies*, 1–58. https://doi.org/10.22059/JCOUNTST.2026.412773.1476

Allaj, E., & Sanfelici, S. (2023). Early warning systems for identifying financial instability. *International Journal of Forecasting, 39*(4), 1777–1803. https://doi.org/10.1016/j.ijforecast.2022.08.004

Allen, F., & Gale, D. (2000). Financial contagion. *Journal of Political Economy, 108*(1), 1–33. https://doi.org/10.1086/262109

Almeida, H., Campello, M., Laranjeira, B., & Weisbenner, S. (2012). Corporate debt maturity and the real effects of the 2007 credit crisis. *Critical Finance Review, 1*(1), 3–58. https://doi.org/10.1561/104.00000001

Alter, A., Hlayhel, B., Kroen, T., & Piontek, T. (2024). *Financial stability in a higher-for-longer interest rate environment: The case of the Middle East and North Africa* (IMF Working Paper No. 2024/080). International Monetary Fund. https://doi.org/10.5089/9798400270017.001

Artzner, P., Delbaen, F., Eber, J.-M., & Heath, D. (1999). Coherent measures of risk. *Mathematical Finance, 9*(3), 203–228. https://doi.org/10.1111/1467-9965.00068

Baker, M., & Wurgler, J. (2006). Investor sentiment and the cross-section of stock returns. *The Journal of Finance, 61*(4), 1645–1680. https://doi.org/10.1111/j.1540-6261.2006.00885.x

Bank for International Settlements. (2024). *Annual economic report 2024*. https://www.bis.org/publ/arpdf/ar2024e.htm

Basel Committee on Banking Supervision. (2019). *Minimum capital requirements for market risk*. Bank for International Settlements. https://www.bis.org/bcbs/publ/d457.htm

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2003). Law, endowments, and finance. *Journal of Financial*

*Economics, 70*(2), 137–181. https://doi.org/10.1016/S0304-405X(03)00144-2

Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In J. B. Taylor & M. Woodford (Eds.), *Handbook of macroeconomics* (Vol. 1C, pp. 1341–1393). Elsevier. https://doi.org/10.1016/S1574-0048(99)10034-X

Billio, M., Getmansky, M., Lo, A. W., & Pelizzon, L. (2012). Econometric measures of connectedness and systemic risk in the finance and insurance sectors. *Journal of Financial Economics, 104*(3), 535–559. https://doi.org/10.1016/j.jfineco.2011.12.010

Bisias, D., Flood, M., Lo, A. W., & Valavanis, S. (2012). A survey of systemic risk analytics. *Annual Review of Financial Economics, 4*, 255–296. https://doi.org/10.1146/annurev-financial-110311-101754

Borio, C. (2014). The financial cycle and macroeconomics: What have we learnt? *Journal of Banking & Finance, 45*, 182–198. https://doi.org/10.1016/j.jbankfin.2013.07.031

Bova, E., Ruiz-Arranz, M., Toscani, F., & Ture, H. E. (2016). *The fiscal costs of contingent liabilities: A new dataset* (IMF Working Paper No. 16/14). International Monetary Fund. https://doi.org/10.5089/9781498303606.001

Brownlees, C., & Engle, R. F. (2017). SRISK: A conditional capital shortfall measure of systemic risk. *The Review of Financial Studies, 30*(1), 48–79. https://doi.org/10.1093/rfs/hhw060

Brunnermeier, M. K. (2009). Deciphering the liquidity and credit crunch 2007–2008. *Journal of Economic Perspectives, 23*(1), 77–100. https://doi.org/10.1257/jep.23.1.77

Brunnermeier, M. K., & Pedersen, L. H. (2009). Market liquidity and funding liquidity. *The Review of Financial Studies, 22*(6), 2201–2238. https://doi.org/10.1093/rfs/hhn098

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics, 97*(3), 470–487. https://doi.org/10.1016/j.jfineco.2010.02.009

Chen, S., Huang, Y., & Ge, L. (2024). An early warning system for financial crises: A temporal convolutional network approach. *Technological and Economic Development of Economy, 30*(3), 688–711. https://doi.org/10.3846/tede.2024.20555

Claessens, S., & Kose, M. A. (2018). *Frontiers of macrofinancial linkages* (BIS Papers No. 95). Bank for International Settlements. https://www.bis.org/publ/bppdf/bispap95.htm

Cucinelli, D., & Soana, M. G. (2023). Systemic risk in non-financial companies: Does governance matter? *International Review of Financial Analysis, 87*, 102601. https://doi.org/10.1016/j.irfa.2023.102601

De Bandt, O., & Hartmann, P. (2000). *Systemic risk: A survey* (European Central Bank Working Paper No. 35). European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp035.pdf

De Long, J. B., Shleifer, A., Summers, L. H., & Waldmann, R. J. (1990). Noise trader risk in financial markets. *Journal of Political Economy, 98*(4), 703–738. https://doi.org/10.1086/261703

Diebold, F. X., & Yilmaz, K. (2014). On the network topology of variance decompositions: Measuring connectedness. *Journal of Econometrics, 182*(1), 119–134. https://doi.org/10.1016/j.jeconom.2014.04.012

Drehmann, M., Borio, C., & Tsatsaronis, K. (2011). Anchoring countercyclical capital buffers: The role of credit aggregates. *International Journal of Central Banking, 7*(4), 189–240. https://www.ijcb.org/journal/ijcb11q4a8.htm

Financial Stability Board. (2024). *Global monitoring report on non-bank financial intermediation 2024*. https://www.fsb.org/2024/12/global-monitoring-report-on-non-bank-financial-intermediation-2024/

Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica, 79*(3), 733–772. https://doi.org/10.3982/ECTA8769

Gilchrist, S., & Zakrajšek, E. (2012). Credit spreads and business cycle fluctuations. *American Economic Review, 102*(4), 1692–1720. https://doi.org/10.1257/aer.102.4.1692

Haldane, A. G., & May, R. M. (2011). Systemic risk in banking ecosystems. *Nature, 469*, 351–355. https://doi.org/10.1038/nature09659

Handri, Mutiara A., Abdullah, F. A., & Nawal, H. (2026). The Dominance of Market Expectations over Systematic Risk on Stock Prices: Evidence from Fixed-Effects Panel Regression in Indonesia's LQ45 Manufacturing Sector. *Applied Quantitative Analysis*, *6*(1), 44–57. https://doi.org/10.31098/quant.4116

Hennig, T., Iossifov, P., & Varghese, R. (2023). *Predicting financial crises: The role of asset prices* (IMF Working Paper No. 2023/157). International Monetary Fund. https://doi.org/10.5089/9798400248498.001

Huynh, T., & Uebelmesser, S. (2024). Early warning models for systemic banking crises: Can political indicators improve prediction? *European Journal of Political Economy, 81*, 102484. https://doi.org/10.1016/j.ejpoleco.2023.102484

International Monetary Fund. (2024). *Global financial stability report: The last mile—Financial vulnerabilities and risks*. https://www.imf.org/en/Publications/GFSR/Issues/2024/04/16/global-financial-stability-report-april-2024

Ivashina, V., & Scharfstein, D. (2010). Bank lending during the financial crisis of 2008. *Journal of Financial Economics, 97*(3), 319–338. https://doi.org/10.1016/j.jfineco.2009.12.001

Jorion, P. (2006). *Value at risk: The new benchmark for managing financial risk* (3rd ed.). McGraw-Hill.

Kalemli-Özcan, Ş., Laeven, L., & Moreno, D. (2022). Debt overhang, rollover risk, and corporate investment: Evidence from the European crisis. *Journal of the European Economic Association, 20*(6), 2353–2395. https://doi.org/10.1093/jeea/jvac018

Kiyotaki, N., & Moore, J. (1997). Credit cycles. *Journal of Political Economy, 105*(2), 211–248. https://doi.org/10.1086/262072

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1998). Law and finance. *Journal of Political Economy, 106*(6), 1113–1155. https://doi.org/10.1086/250042

Li, X.-L., Li, H., Ge, X., & Si, D.-K. (2023). Capital market liberalization and systemic risk of non-financial firms: Evidence from Chinese Stock Connect scheme. *Pacific-Basin Finance Journal, 82*, 102190. https://doi.org/10.1016/j.pacfin.2023.102190

Melati, M., Mido, M. S. S., Hasddin, H., Misnawati, M., Rama, M. I., Fadli, A. M. D., Nartin, N., Mirad, M., Marjani, M., Dahlifah, D., & Mais, R. G. (2026). Bank profitability level based on good corporate governance, macroeconomics, and specific banks in foreign exchange banks in Indonesia. *Journal of Governance Risk Management Compliance and Sustainability, 6*(1), 43–61. https://doi.org/10.31098/jgrcs.v6i1.3502

Minsky, H. P. (1986). *Stabilizing an unstable economy*. Yale University Press.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147–175. https://doi.org/10.1016/0304-405X(77)90015-0

OECD & Joint Research Centre. (2008). *Handbook on constructing composite indicators: Methodology and user guide*. OECD Publishing. https://doi.org/10.1787/9789264043466-en

Oet, M. V., Dooley, J. M., Janosko, A. C., Gramlich, D., & Ong, S. J. (2015). Supervising system stress in multiple markets. *Risks, 3*(3), 365–389. https://doi.org/10.3390/risks3030365

Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. *The Journal of Finance, 49*(3), 1015–1040. https://doi.org/10.1111/j.1540-6261.1994.tb00086.x

Purnawan, V., & Prasetyo, A. D. (2021). Domestic and foreign banks' stability in Indonesia: The grey zone trap and key determinants. *Applied Quantitative Analysis, 1*(2), 1–16.

https://doi.org/10.31098/quant.596

Putri, A. A., Martusa, R., & Meythi. (2024). Performance of companies and controlling share ownership on company liquidity: Evidence from emerging markets. *Applied Quantitative Analysis, 4*(1), 1–11. https://doi.org/10.31098/quant.2044

Reimann, C. (2024). Predicting financial crises: An evaluation of machine learning algorithms and model explainability for early warning systems. *Review of Evolutionary Political Economy, 5*, 51–83. https://doi.org/10.1007/s43253-024-00114-4

Rey, H. (2015). *Dilemma not trilemma: The global financial cycle and monetary policy independence* (NBER Working Paper No. 21162). National Bureau of Economic Research. https://doi.org/10.3386/w21162

Roy, S. (2023). Do changes in risk perception predict systemic banking crises? *Journal of Risk and Financial Management, 16*(11), 463. https://doi.org/10.3390/jrfm16110463

Saisana, M., & Tarantola, S. (2002). *State-of-the-art report on current methodologies and practices for composite indicator development*. European Commission Joint Research Centre.

Shleifer, A., & Vishny, R. W. (2011). Fire sales in finance and macroeconomics. *Journal of Economic Perspectives, 25*(1), 29–48. https://doi.org/10.1257/jep.25.1.29

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Torraco, R. J. (2016). Writing integrative literature reviews: Using the past and present to explore the future. *Human Resource Development Review, 15*(4), 404–428. https://doi.org/10.1177/1534484316671606

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly, 26*(2), xiii–xxiii. https://doi.org/10.2307/4132319

## APPENDIX

### Appendix A – DFAS-FEP Authorship Classification and Compliance:

This manuscript complies with the DFAS-FEP Protocol, an authorship-governance protocol introduced by the author (Alaali, 2025).

DFAS-FEP (Dynamic Financial Applied Meta-Science – Future Engine Prototype Protocol) provides an ethical protocol to ensure transparent and accountable authorship in AI-assisted financial research. It defines and enforces the distinction between fully human-generated content and AI-supported elements to uphold integrity, intellectual responsibility, and traceability across all components of this manuscript.

This classification directly supports the ethical architecture of the DFAS-IFRS Code of Ethics, which applies DFAS-FEP standards to financial disclosures influenced by artificial intelligence.

For reference, see the published DFAS-FEP Protocol:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5260517

**Appendix A.1**. (DFAS-FEP) Authorship Classification Table for This Manuscript

| Manuscript Component | DFAS–FEP Class | Justification |
|---|---|---|
| **Alaali Systemic Risk Index (ASRI)** | **Class 1** | The core ASRI conceptual architecture was independently developed by the author. |
| **Vulnerability–Stress–Transmission–Outcome Architecture** | **Class 1** | The distinction between underlying vulnerability, activating and conditioning stress, transmission capacity, systemic-risk pressure, and potential outcomes was developed by the author. |
| **Corporate Financial** | **Class 1** | The organization of leverage and debt burden, |

| | | |
|---|---|---|
| **Fragility** | | liquidity and refinancing pressure, and earnings and cash-flow fragility as underlying corporate vulnerability was developed by the author. |
| **Financial-Market Stress** | **Class 1** | Its conceptual role as an activation and amplification mechanism within ASRI was structured by the author. |
| **Macro-Financial Instability** | **Class 1** | Its conceptual role as the conditioning environment for systemic-risk development was structured by the author. |
| **Transmission Exposure Architecture** | **Class 1** | Financial, real-economy and strategic, market-confidence, and sovereign-financial transmission channels were structured by the author. |
| **Dynamic Feedback-Loop Mechanism** | **Class 1** | The reinforcing systemic-risk pathway and feedback logic were independently developed by the author. |
| **Theoretical Propositions (P1–P6)** | **Class 1** | The six ASRI propositions were independently formulated by the author. |
| **Operationalisation and Validation Architecture** | **Class 1** | The conceptual pathway for indicator selection, alternative aggregation structures, calibration, validation, and robustness testing was author-developed. |
| **Country-Sensitive Calibration Principle** | **Class 1** | The requirement for jurisdiction-sensitive calibration rather than uniform thresholds was independently structured by the author. |
| **Narrative Structure and Analytical Exposition** | **Class 2** | AI assistance was limited to linguistic and structural refinement. |
| **Tables and Presentation** | **Class 2** | Substantive content was author-designed; AI assistance was limited to presentation refinement. |
| **Literature Review and Cross-Referencing** | **Class 2** | Literature interpretation was author-directed; AI assistance supported literature organization and citation alignment. |
| **Appendices and Compliance Documentation** | **Class 2** | AI assistance was limited to formatting and structural consistency. |

Overall Manuscript Classification: Class 2 – AI-Assisted, Author-Validated

Core ASRI Framework and Architecture: Class 1 – Fully Human-Authored

**Additional Clarifications**

**Human-Originated Content (Class 1)**: All substantive ASRI concepts, dimensions, transmission mechanisms, propositions, dynamic feedback logic, and operationalisation architecture were independently developed by the author.

**AI-Assisted Content (Class 2)**: AI tools were used only for non-substantive linguistic refinement, formatting, presentation, and citation alignment.

**Integrity Safeguards**: All AI-assisted content was manually reviewed and validated under DFAS-FEP v1.6.

**Appendix B – Version History Log (VHL)**

**Version 1.0** – First Published on SSRN on March 20, 2025; Last Revised on June 14, 2025.

- https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5179825

- The manuscript introduced the initial foundations of the Alaali Systemic Risk Index (ASRI) as a forward-looking framework integrating corporate financial vulnerabilities with systemic market conditions. It presented an initial formulation, illustrative crisis applications, and comparative positioning against established systemic-risk measures such as SRISK, CoVaR, and Value-at-Risk.
- Alaali-ACS: 0 | Classification: Class II – AI-Assisted, Author-Validated

**Version 2.0** – Revised August 29, 2026.

- The manuscript was substantially reconstructed to develop ASRI as an integrated conceptual index framework comprising four dimensions: Corporate Fragility, Financial-Market Stress, Macro-Financial Instability, and Transmission Exposure. The revision clarifies the distinction between underlying vulnerability, activating stress conditions, transmission channels, and systemic-risk outcomes.
- The revised version removes the earlier illustrative numerical crisis scores, explicitly defines ASRI as conceptual rather than calibrated or empirically validated, and strengthens the theoretical propositions, dynamic feedback logic, country sensitivity, indicator-selection protocol, and pathway for future weighting, calibration, empirical validation, robustness, and out-of-sample testing.
- Alaali-ACS: 0 | Classification: Class II – AI-Assisted, Author-Validated

**Version 3.0** – Major Revision, September 4, 2026.

- The manuscript was substantially revised in response to external peer review, strengthening ASRI's vulnerability–stress–transmission–outcome architecture, literature positioning, construct boundaries, theoretical propositions, and methodology.
- The revision further clarifies ASRI as a conceptual index framework requiring future calibration and empirical validation, while strengthening its operationalisation and validation pathway.
- Alaali-ACS: 0 | Classification: Class II – AI-Assisted, Author-Validated